

FORCED SWIM SYSTEM

USER'S MANUAL

SOF-842-3 and Forced Swim Hardware User's Manual
DOC-216
Rev. 1.0

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MED Associates, Inc.
P.O. Box 319
St. Albans, Vermont 05478
www.med-associates.com

TABLE OF CONTENTS

Chapter 1	1
Introduction	1
General Computer Environment.....	1
Chapter 2	2
Assembly Instructions	2
Hardware Guide	2
Light Panel Installation	4
Installing the Camera Mount.....	5
Hardware Assembly	6
Adjusting the Camera Focus and Aperture	7
Wiring Instructions.....	8
Chapter 3	9
User Interface.....	9
Menu Bar.....	9
File Menu	9
Graph Menu.....	10
Zoom Menu	11
Component Analysis Menu	11
Help Menu.....	12
Motion Index Graph	13
Upper and Lower Thresholds and Time Cursor	13
Experiment Data	14
Experiment Information	14
Range Cursors.....	15
Video Display and Playback Controls	16
Chapter 4	17
Using the Software	17
Creating a Motion Data File	17
Opening a Motion Data (*.fsa) File	18
Zooming in on the Motion Index Graph	19
Analyzing Data	20
Saving a Motion Data (*.fsa) File	20

Chapter 5	21
Component Analysis.....	21
Adding Components	21
Editing Components	22
Deleting Components	22
Saving a Component Analysis	22
Loading a Component Analysis.....	22
Running a Component Analysis	23
Example *.csv File	24
Appendix A.....	25
Software Installation.....	25

CHAPTER 1

Introduction

The Forced Swim Test is a standard means of testing the pharmacological effects of antidepressants in mice and rats. Dose-dependent effects on immobility are evident using the Forced Swim Test, and the Med Associates' software provides researchers with a reliable method of behavioral quantification.

The MED Associates Forced Swim System includes everything needed to conduct this behavioral assay in rodent species. The primary dependent variable is the amount of time spent immobile during the experimental session. The software provides an index of average motion, and data are displayed in real time.

The MED Associates Forced Swim System includes the Video Monitor Plug-In for Forced Swim as well as the Forced Swim hardware. The Video Monitor Plug-In for Forced Swim allows the researcher to analyze video recorded using the MED Associates Video Monitor software.

General Computer Environment

- 3.4 GHz Processor
- 1 GB RAM
- Windows™ 2000 SP4, XP or Vista
- FireWire Card
- FireWire Camera(s)

CHAPTER 2

Assembly Instructions

Hardware Guide

Figure 2.1 - ENV-590 Cylinder



Figure 2.2 - ENV-591 Test Cubicle

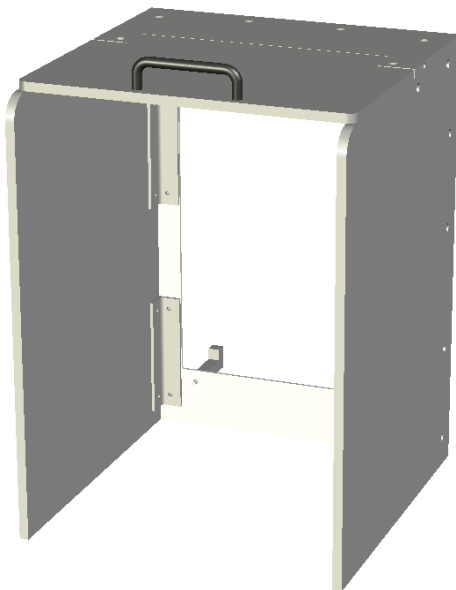


Figure 2.3 - Camera Plate

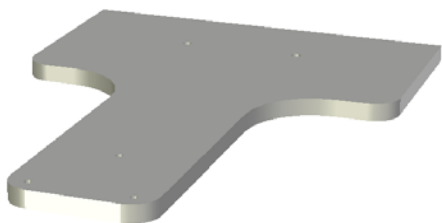


Figure 2.4 – Alignment Plate



Figure 2.5 - NIR-100 Light Controller Front Panel

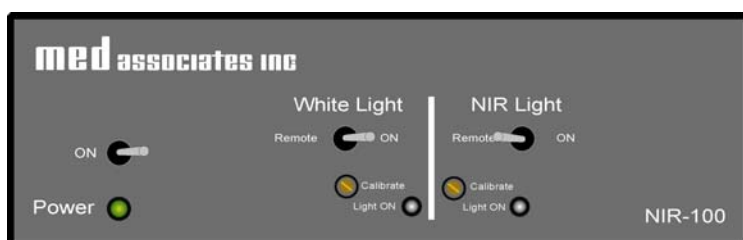
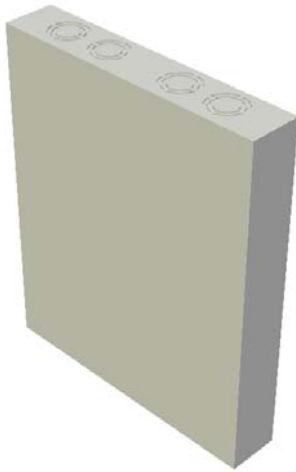


Figure 2.6 - ENV-598 Camera Mount and FireWire Camera



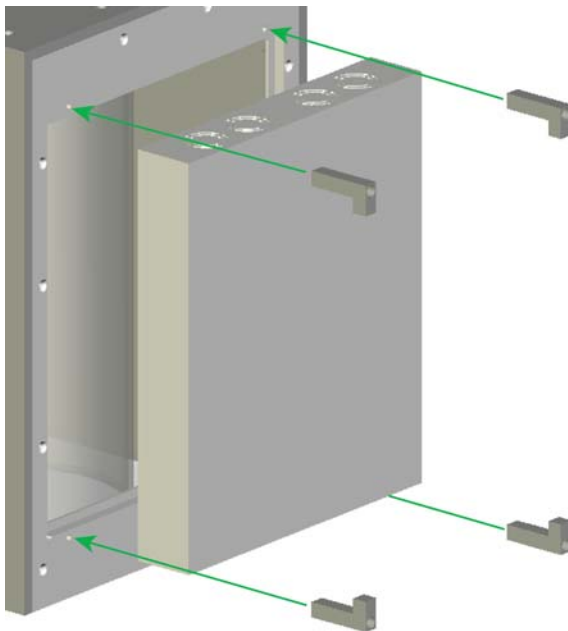
Figure 2.7 - NIR-100R Light Panel



Light Panel Installation

Refer to Figure 2.8 when completing these steps.

Figure 2.8 - Installing the Light Panel



1. Orient the NIR-100R Light Panel so that the light is facing into the test cubicle and the connector is facing down.
2. Place the NIR-100R Light Panel inside the groove on the back of the test cubicle.
3. Use the four brackets and included screws to secure the light panel to the back of the test cubicle.

Installing the Camera Mount

Refer to Figure 2.9 when completing these steps.

Figure 2.9 - Installing the Camera Mount

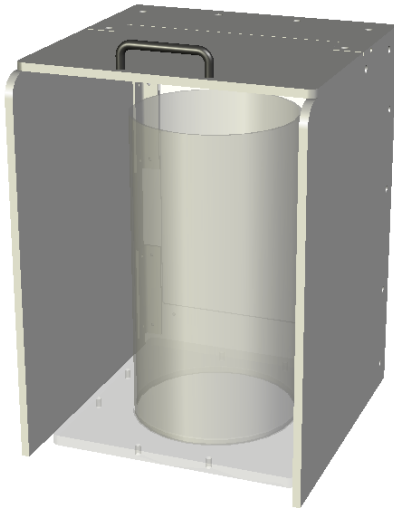


1. Orient the ENV-598 Camera Mount over the pre-drilled holes in the Camera Plate.
2. Secure the ENV-598 Camera Mount in place using the included screws.
3. Thread the camera onto the Camera Mount.

Hardware Assembly

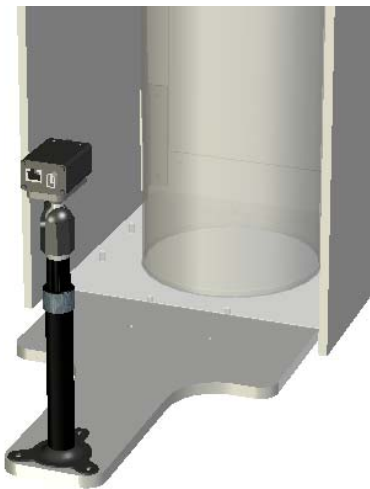
1. Place the ENV-590 Cylinder in the desired location for the assembled system, as it is very difficult to move once it is filled with water.
2. Fill the ENV-590 Cylinder with water.
3. Place the ENV-591 Test Cubicle around the ENV-590 Cylinder, as shown in Figure 2.10.

Figure 2.10 - Cylinder Inside the Enclosure



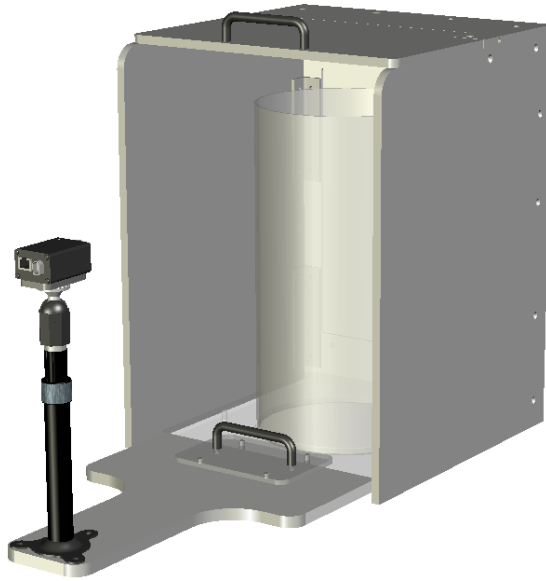
4. Orient the Camera Plate as shown in Figure 2.11.

Figure 2.11 - Camera Plate Aligned



5. Secure the Camera Plate in place using the Alignment Plate. Two of the pins on the Alignment Plate fit into the holes in the Camera Plate and the other two fit into the Cylinder base, as shown in Figure 2.12.

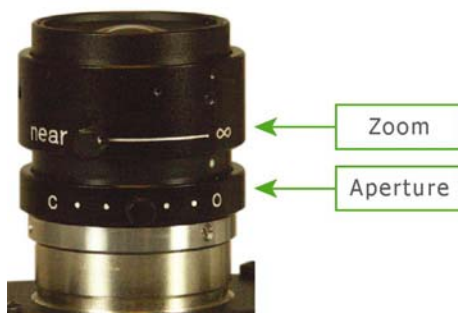
Figure 2.12 - Assembled Hardware



Adjusting the Camera Focus and Aperture

Open the Video Monitor software application and open the Camera Window (refer to the "Video Monitor Users Manual"). To adjust the zoom, loosen the thumbscrew on the ring, and make the necessary adjustment. Once proper image clarity is achieved, tighten the thumbscrew on the ring. It is recommended that the lens aperture be in the maximal open (O) position, as shown below.

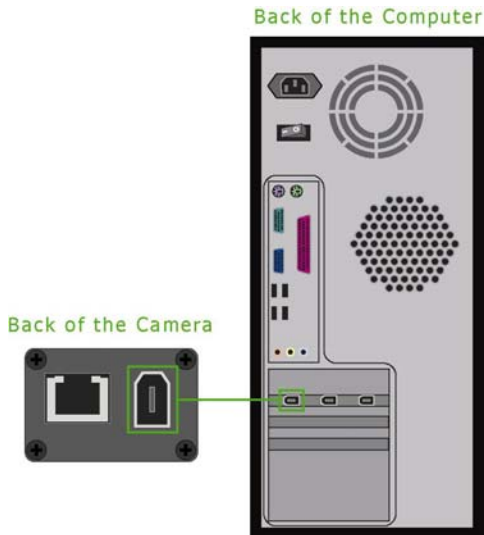
Figure 2.13 - Camera Zoom and Aperture Rings



Wiring Instructions

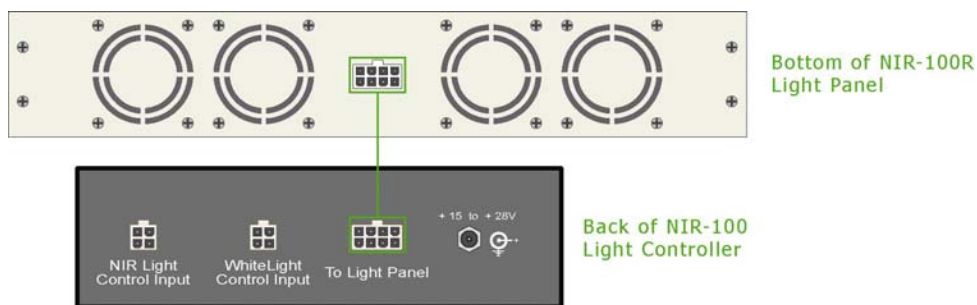
1. Using the FireWire cable, connect the FireWire camera to the FireWire card.

Figure 2.14 - FireWire Cable Connection



2. Using the NIR-101 cable, connect the **To Light Panel** connector on the back of the NIR-100 Light Controller to the connector on the bottom of the NIR-100R Light Panel.

Figure 2.15 - Connect the Light Panel to the Light Controller



3. Using the power adapter, connect the NIR-100 Light Controller to a GFCI outlet.

Figure 2.16 - Connect Light Controller to GFCI Outlet

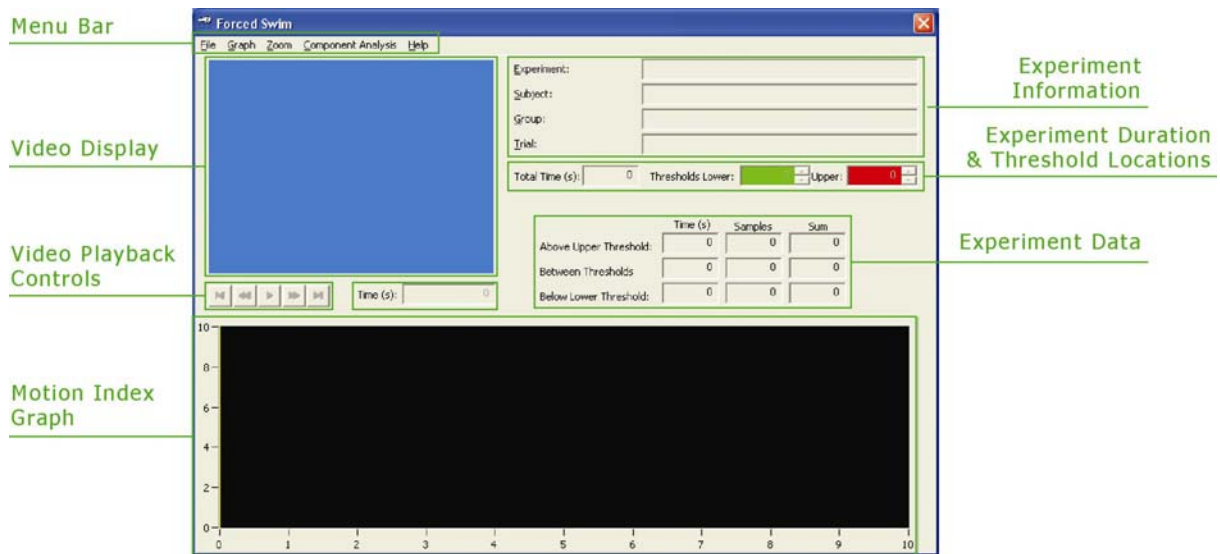


CHAPTER 3

User Interface

This chapter describes the menus and features of the Forced Swim software application. Open the Forced Swim software application and the main screen, shown below, will appear.

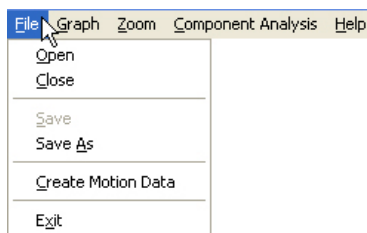
Figure 3.1 – Main Screen Labeled



Menu Bar

File Menu

Figure 3.2 - File Menu

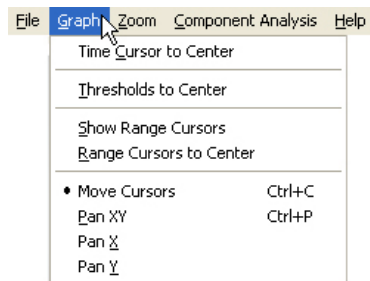


Menu Item	Description	For More Info
Open	Open .fsa file	Chapter 4, Opening a Motion Data (*.fsa) File
Close	Close .fsa file	N/A
Save	Save the .fsa file using the same File Name and Location	Chapter 4, Saving a Motion Data (*.fsa) File

Menu Item	Description	For More Info
Save As	Save the .fsa file using a different File Name and/or Location	Chapter 4, Saving a Motion Data (*.fsa) File
Create Motion Data	Create an .fsa file from a .wmv file	Chapter 4, Creating a Motion Data File
Exit	Close the software application	N/A

Graph Menu

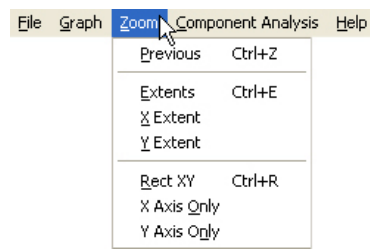
Figure 3.3 - Graph Menu



Menu Item	Description	For More Info
Time Cursor to Center	Moves the Time Cursor to the center of the Motion Index Graph	Chapter 3, Upper and Lower Thresholds and Time Cursor
Thresholds to Center	Moves the Threshold Cursors to the center of the Motion Index Graph	Chapter 3, Upper and Lower Thresholds and Time Cursor
Show Range Cursors	Displays the Range Cursors on the Motion Index Graph	Chapter 3, Upper and Lower Thresholds and Time Cursor
Range Cursors to Center	Moves the Range Cursors to the center of the Motion Index Graph	Chapter 3, Upper and Lower Thresholds and Time Cursor
Move Cursors	Mouse pointer will move cursors only	Chapter 3, Motion Index Graph
Pan XY	Mouse pointer will pan the motion index graph and cursors along both the X and Y-axes.	Chapter 3, Motion Index Graph
Pan X	Mouse pointer will pan the motion index graph and cursors along the X-axis only	Chapter 3, Motion Index Graph
Pan Y	Mouse pointer will pan the motion index graph and cursors along the Y-axis only	Chapter 3, Motion Index Graph

Zoom Menu

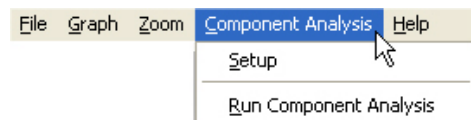
Figure 3.4 - Zoom Menu



Menu Item	Description
Previous	Return to the previous zoom selection
Extents	Automatically zooms so that the motion data fills the graph area
X Extent	Automatically zooms so that all of the x-axis (time) data is visible in the graph area
Y Extent	Automatically zooms so that all of the y-axis (motion) data is visible in the graph area
Rect XY	Allows the user to click and drag over the desired view area to zoom along both the X- and Y-axes
X Axis Only	Allows the user to click and drag over the desired view area to zoom along the X-axis only
Y Axis Only	Allows the user to click and drag over the desired view area to zoom along the Y-axis only

Component Analysis Menu

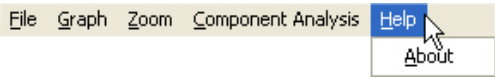
Figure 3.5 - Component Analysis Menu



Menu Item	Description	For More Info
Setup	Opens the Component Setup screen	Chapter 5, Component Analysis
Run Component Analysis	Opens the Component Summary Report screen	Chapter 5, Running a Component Analysis

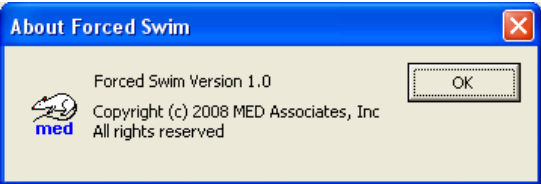
Help Menu

Figure 3.6 - Help Menu



Menu Item	Description	For More Info
About	Displays the software version and copyright information	Screen shown in Figure 3.7

Figure 3.7 - About Screen



Motion Index Graph

The subject's behavior is quantified as an *index of motion*. All movement within the forced swim chamber is registered by the software as a change in video pixel composition over time. Therefore, robust and fast movements will be recorded as a large relative changes in video-pixel composition, and small, refined, and slow-movements will be registered as somewhat smaller relative changes in pixel composition. During analysis, movement is represented as a graph (motion index vs. time) in a non-cumulative manner.

Upper and Lower Thresholds and Time Cursor

The Motion Index Graph also contains Upper and Lower Thresholds and the Time Cursor. The location of the Upper and Lower Thresholds is user-defined and can be adjusted by either clicking and dragging the threshold lines to the desired location (be sure that **Move Cursors** is selected on the Graph menu) or by entering the motion index values into the **Thresholds Lower and Upper** fields on the main screen (Figure 3.1).

The Time Cursor is used to indicate the current place in the video and its location corresponds to the **Time (s)** field under the Video Display Window (Figure 3.13). The video can be advanced or reversed by clicking and dragging the Time Cursor to the desired location on the Motion Index Graph.

Figure 3.8 - Thresholds and Video Location Indicator Labeled

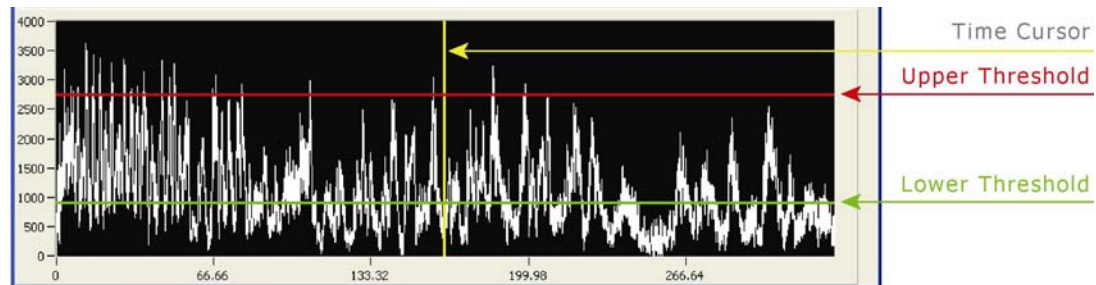
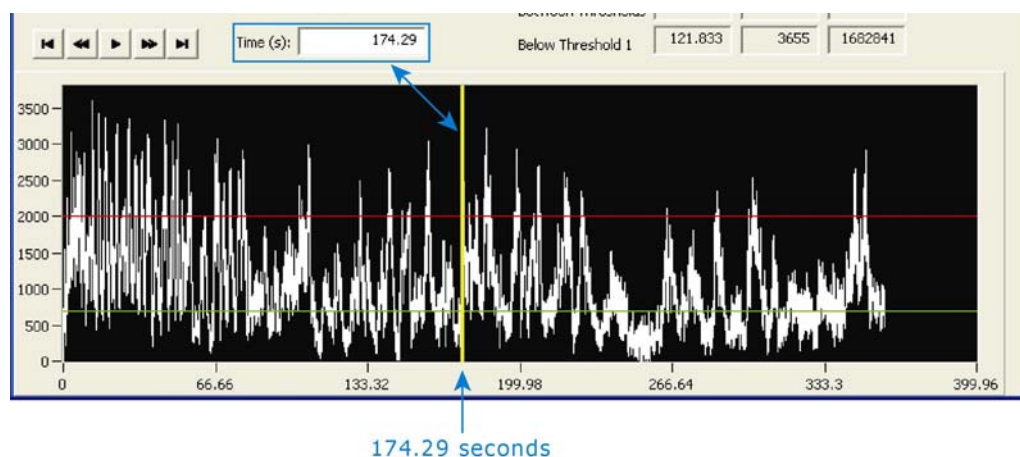


Figure 3.9 – Time Cursor and Time (s) Correspond



Experiment Data

The Experiment Data portion of the Main Screen, shown below, displays the data that corresponds to the position of the Upper and Lower Thresholds. The **Time (s)** column contains the amount of time, in seconds that the motion index was above the Upper Threshold, between the Upper and Lower thresholds and below the Lower threshold. The **Samples** column contains the number of frames that the motion index was above the Upper Threshold, between the Upper and Lower Thresholds and below the Lower Threshold. The **Sum** column contains the sum of the data above the Upper Threshold, between the Upper and Lower Thresholds and below the Lower Threshold.

Figure 3.10 - Experiment Data

	Time (s)	Samples	Sum
Above Upper Threshold:	0	0	0
Between Thresholds	0	0	0
Below Lower Threshold:	0	0	0

Experiment Information

The Experiment Information portion of the Main Screen, shown below, allows the user to enter useful information relating to the video file that will be saved with the analysis.

Figure 3.11 - Experiment Information

Experiment:	Forced Swim Experiment 1
Subject:	Subject 1
Group:	Group 1
Trial:	Testing 1

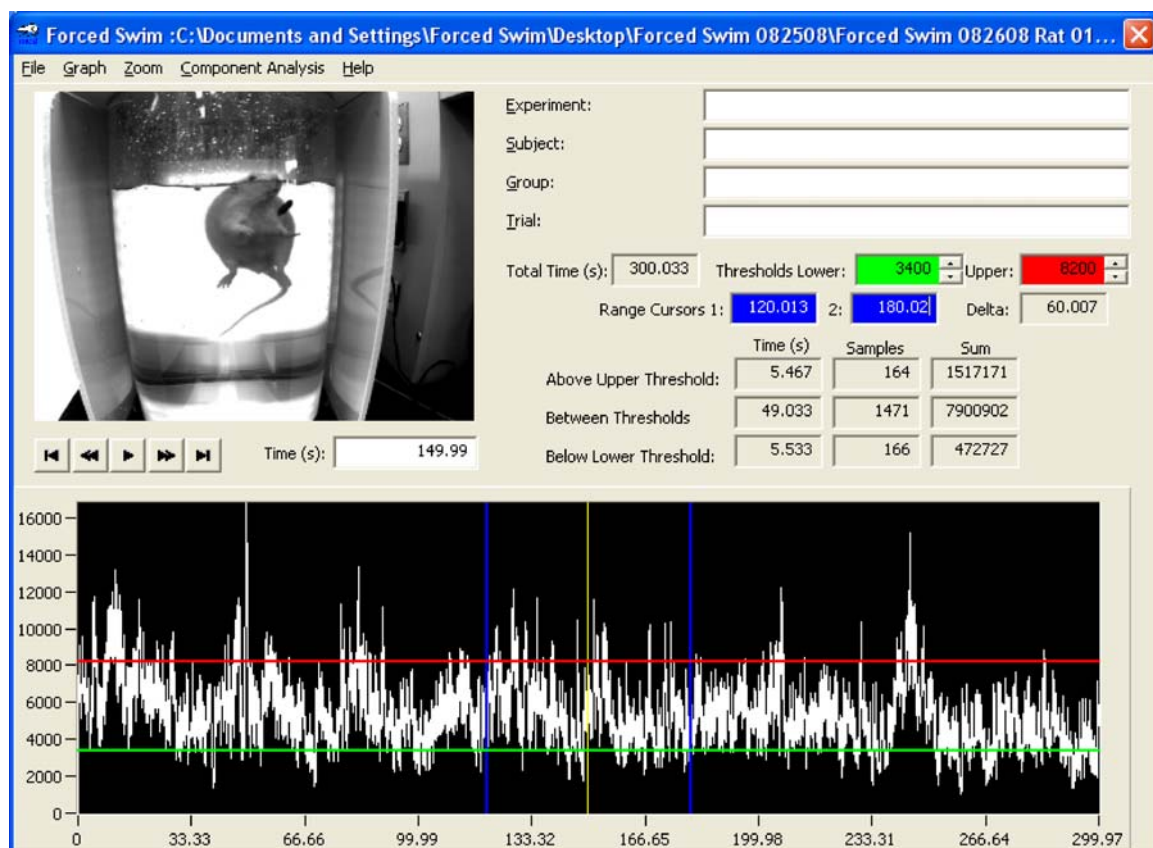
Range Cursors

To obtain data from a *specified interval* of time within the session, use the **Range Cursors**. Enable the Range Cursors by selecting **Graph | Show Range Cursors**. The blue range cursors will appear on the Motion Index Graph and the position of the cursors as well as the time difference (Delta) between the cursors will appear above the Experiment Data, as shown below.

Adjust the position and length of the specified interval by clicking and dragging the cursors to the desired position in the Motion Index Graph or by entering the desired positions in the Range Cursors 1 and 2 fields. Adjusting the position of the Range Cursors will alter the data shown in the Experiment Data portion of the Main Screen (Figure 3.1 and Figure 3.10).

The figure below shows the Range cursors. Note that when the Range Cursors are shown, the Experiment Data reflect only the data that exist between the Range Cursors on the Motion Index Graph.

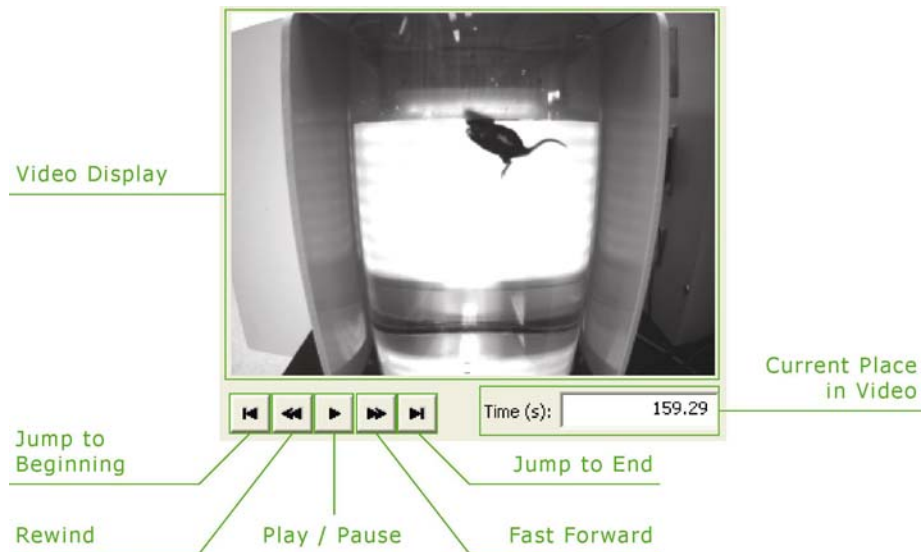
Figure 3.12 - Range Cursors



Video Display and Playback Controls

The Video Display and Playback Controls portion of the main screen is shown below. The Jump to Beginning, Rewind, Fast Forward and Jump to End buttons will function only when the video is Paused. If the video is paused, the video can be advanced or reversed by clicking and dragging the Time Cursor to the desired location on the Motion Index Graph (see the **Upper and Lower Thresholds and Time Cursor** section of this manual).

Figure 3.13 - Video Display and Playback Controls



CHAPTER 4

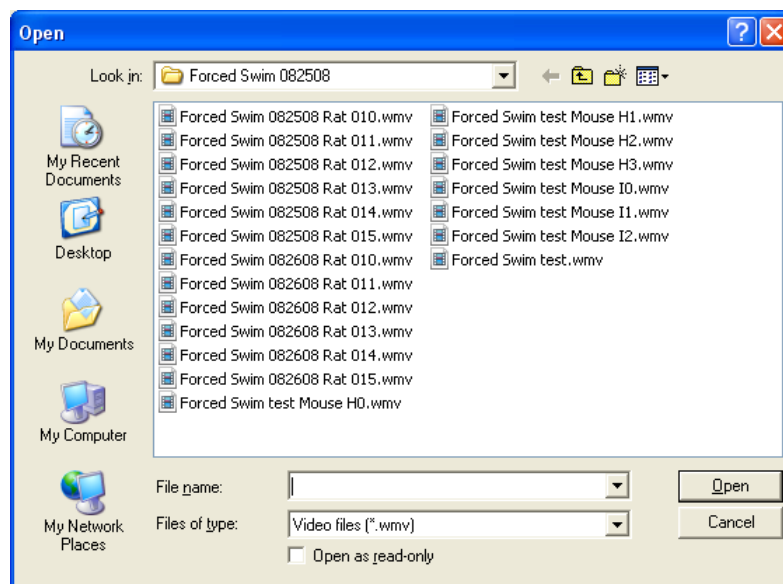
Using the Software

Creating a Motion Data File

The process of creating a motion data file is essentially extracting Motion Index data from a video file. The motion data file will be saved as an *.fsa file and can be opened using the Video Monitor Plug-In for Forced Swim.

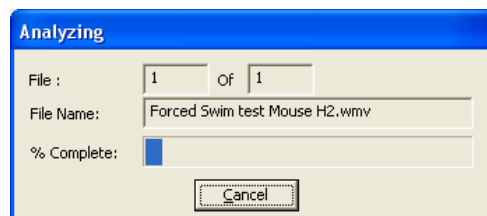
To create a motion data file open the software application and the Main Screen (Figure 3.1) will appear. Select **File | Create Motion Data** and the Open screen shown in Figure 4.1 will appear.

*Figure 4.1 – Select *.wmv File*



Next select the video (*.wmv) file to analyze and click **Open**. The Analyzing screen shown in Figure 4.2 will appear. When this screen disappears an *.fsa file has been created using the same file name and location as the *.wmv file.

Figure 4.2 – Analyzing Screen with Status Bar



Opening a Motion Data (*.fsa) File

Once a motion data (*.fsa) file has been created, it can be opened using the Video Monitor Plug-In for Forced Swim. From the Main Screen (Figure 3.1) select **File | Open**. The screen shown in Figure 4.3 will appear. Select the file to open and click **Open**. The Main Screen will appear as shown in Figure 4.4.

Figure 4.3 – Select the Motion Data (*.fsa) File to Open

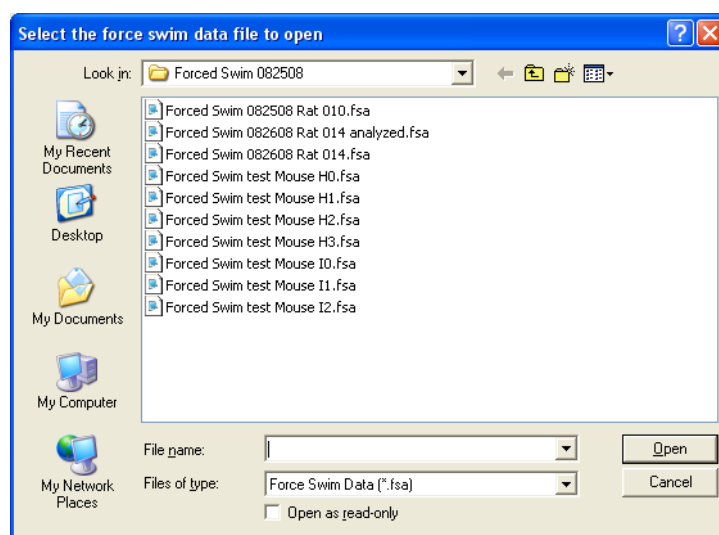
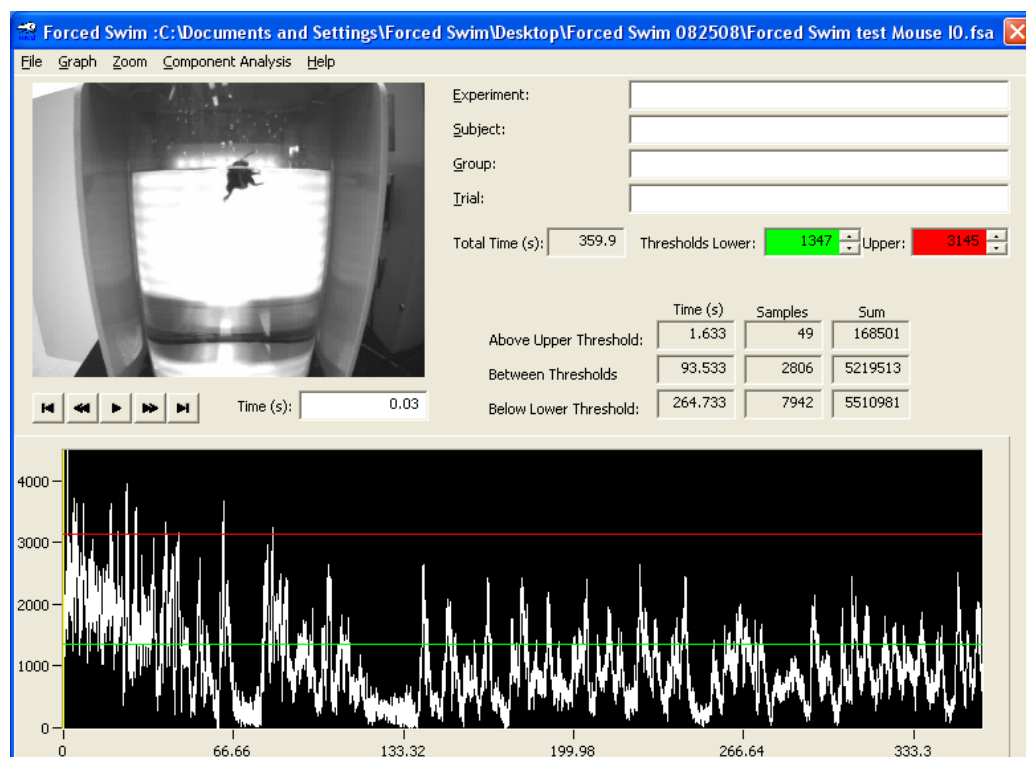


Figure 4.4 - Open *.fsa File



Zooming in on the Motion Index Graph

When a motion data (*.fsa) file is initially opened the Motion Index Graph will be displayed so that all of the Motion Index data is contained within the Graph Display, as shown in Figure 4.4. It may be necessary to adjust the zoom to better view the data. There are several options on the **Zoom** menu that allow the user to optimize data viewing. Please refer to **Chapter 3, Zoom Menu** for definitions of each menu item.

For the example, selecting **Zoom | Rect XY** allows the user to use the cursor to click and drag over the area to zoom in on, as shown in Figure 4.5. This will result in the data being zoomed in on along both the X- and Y-axes, as shown in.

Figure 4.5 – Zoom, Rect XY

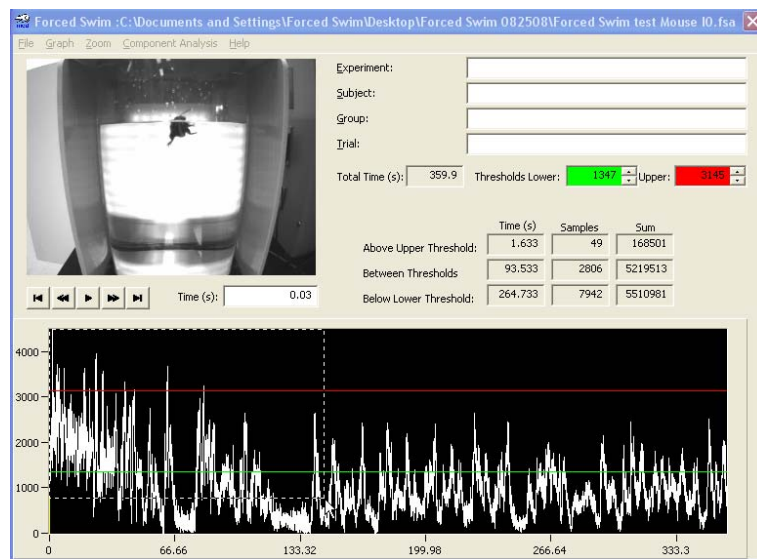
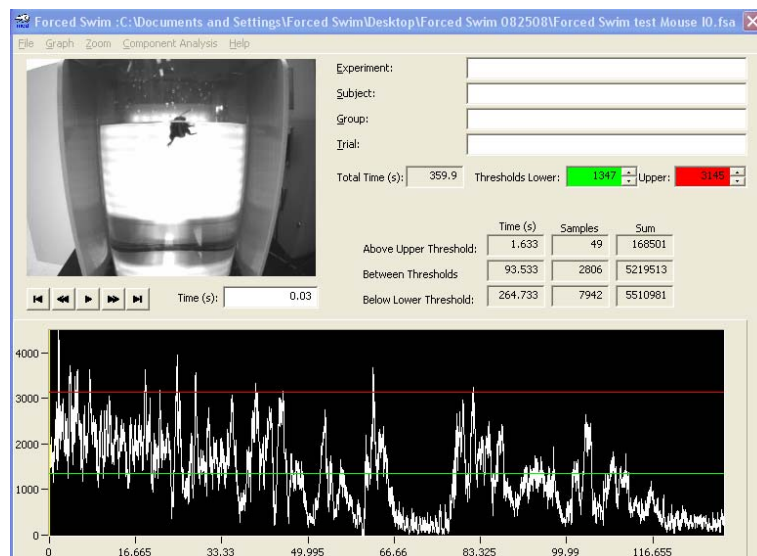


Figure 4.6 - Data Zoomed Along X and Y Axes



Analyzing Data

With the *.fsa file open and the Motion Index Graph properly zoomed in; place the Upper and Lower Thresholds in the appropriate locations. If the Range Cursors are being used, they should be placed in the desired locations on the Motion Index Graph. The data contained in the Experiment Data portion of the main screen are calculated using the Threshold and Cursor positions, and are updated each time a Threshold or Cursor is moved.

Any relevant text may be entered in the Experiment, Subject, Group and Trial fields.

Saving a Motion Data (*.fsa) File

Saving a Motion Data (*.fsa) files will retain the current Threshold and Cursor positions as well as any text entered in the Experiment, Subject, Group and Trial fields. To save the Motion Data file using the same file name and location, click **File | Save**. To save the Motion Data file using a different file name and/or location, click **File | Save As**.

CHAPTER 5

Component Analysis

One may choose to compare data across different events within a single experimental session. For example, one may choose to report immobility in one-minute increments over the course of a session. This can be done using Component Analysis.

Adding Components

To begin, open an *.fsa file, and select **Component Analysis | Setup**. The Component Setup screen shown in Figure 5.1 will appear. To define each component click on the **Add** button and the Component screen shown in Figure 5.2 will appear.

Figure 5.1 – Component Setup Screen

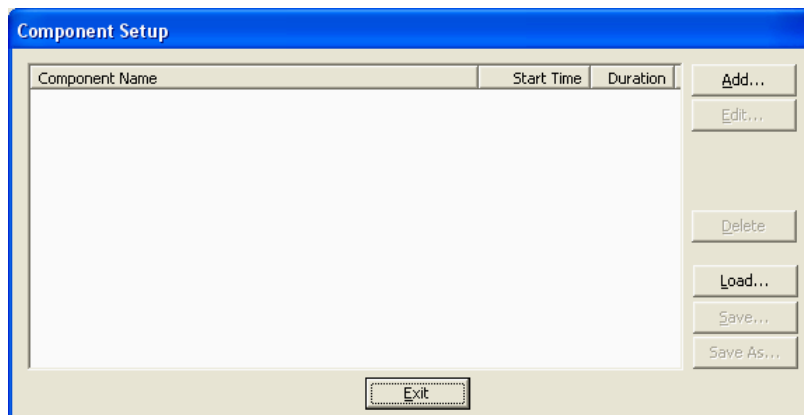
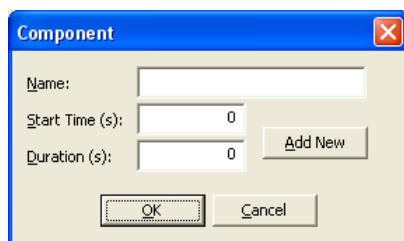


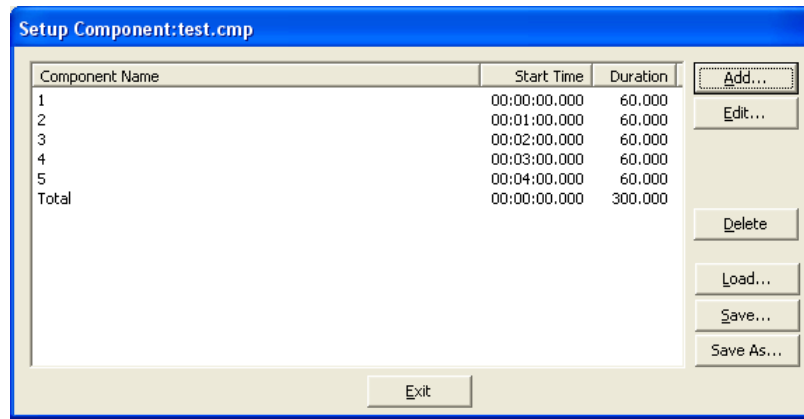
Figure 5.2 – Component Screen



Name each component, and enter the **Start Time** (s) and the **Duration** (s). The Counts and Times Above, Between and Below the Thresholds will be calculated for each component, and the Start Time and Duration of the component determine the parameters for the calculation. Click **OK** to add the new component and close the Component screen, or click **Add New** to add the new component and keep the Component screen open. Once the Component screen is closed the Component Setup screen will display any components that have been added.

An example Setup Component screen with several components added is shown in Figure 5.3.

Figure 5.3 – Example Component Setup Screen



Editing Components

To edit the Name, Start Time or Duration of a component, highlight the desired component and click Edit. The Component screen, shown in Figure 5.2, will appear. Make the necessary changes and click **OK**.

Deleting Components

Highlight the desired component and click **Delete** and the component will be removed from the Setup Component list.

Saving a Component Analysis

Once all of the necessary components have been added, click **Save** and enter a file name and location. The component analysis will be saved as a *.cmp file.

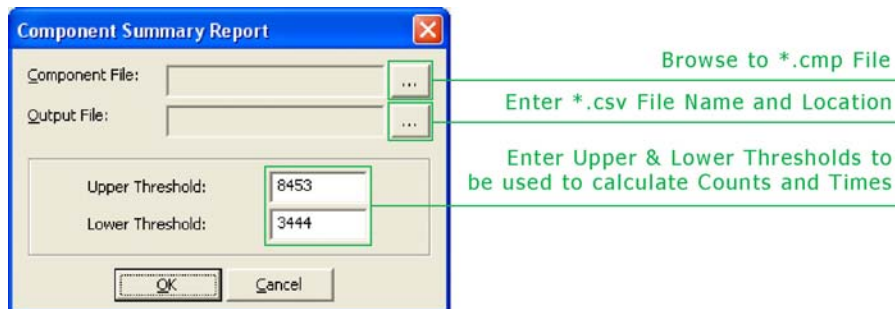
Loading a Component Analysis

To load an existing component analysis (*.cmp) file, click **Load** and select the file. This file may now be added to or edited. If any changes are made to this file, click **Save** to save the *.cmp file using the same file name and location or click **Save As** to use a different file name or location.

Running a Component Analysis

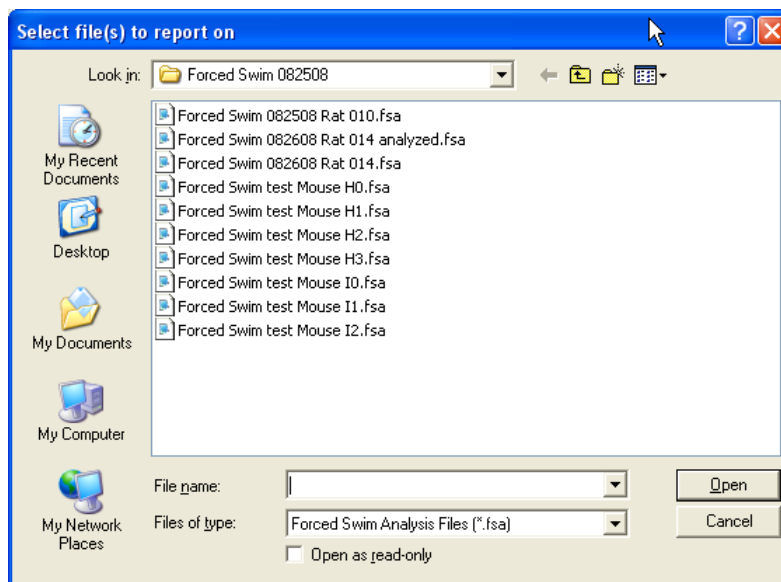
To run a component analysis, click **Component Analysis | Run Component Analysis**. The Component Summary Report screen, shown in Figure 5.4 will appear. Click on the ... button next to "Component File" and browse to the desired *.cmp file. The click on the ... button next to "Output File", select the desired output location and enter an Output File Name. Next enter the Upper and Lower Threshold that should be used to calculate the Above, Between and Below Threshold Counts and Times. Click **OK** and the Select file(s) to report on screen shown in Figure 5.5 will appear.

Figure 5.4 - Component Summary Report Screen



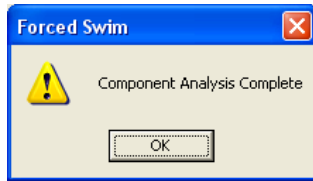
Select the *.fsa file(s) to run the component analysis on and click OK. The screen shown in Figure 5.6 will appear.

Figure 5.5 – Select File(s) to Report On



The component analysis is now complete. The output *.csv file can be viewed using Microsoft Excel™. An example Component Analysis *.csv file is shown in Figure 5.7.

Figure 5.6 – Component Analysis Complete



Example *.csv File

The Component Analysis file contains the Counts and Times Below the Lower, Between and Above the Upper Thresholds for each Component. Any text that was entered in the Experiment, Subject, Group and Trial fields on the Main Screen will appear in this file, as well as the Name, Start Time, Duration, Start Frame and Duration Frames for each Component.

Figure 5.7 - Example Component Analysis File

Date :	9/3/2008 13:31											
Threshold 1:	3444											
Threshold 2:	8453											
Component Details												
Component Name	Start Time	Duration (s)	Start Frame	Duration Frames								
1	00:00.0	60	0	1800								
2	01:00.0	60	1800	1800								
3	02:00.0	60	3600	1800								
4	03:00.0	60	5400	1800								
5	04:00.0	60	7200	1800								
Total	00:00.0	300	0	9000								
					Samples				Time			
Experiment	Subject	Group	Trial	Component Name	Below Low Threshold	Between Thresholds	Above Upper Threshold	Below Threshold 1	Between Thresholds	Above Threshold 2		
Forced Swim Test	Rat 1	Group 1	Testing 1	1	71	1465	264	2.37	48.83	8.8		
Forced Swim Test	Rat 1	Group 1	Testing 1	2	186	1546	68	6.2	51.53	2.27		
Forced Swim Test	Rat 1	Group 1	Testing 1	3	179	1481	140	5.97	49.37	4.67		
Forced Swim Test	Rat 1	Group 1	Testing 1	4	178	1587	35	5.93	52.9	1.17		
Forced Swim Test	Rat 1	Group 1	Testing 1	5	432	1278	90	14.4	42.6	3		
Forced Swim Test	Rat 1	Group 1	Testing 1	Total	1046	7357	597	34.87	245.23	19.9		

APPENDIX A

Software Installation

Insert the Forced Swim CD into the CD-ROM drive and the screen shown in Figure A.1 will appear.

Figure A.1 - Forced Swim Main Screen



Click **Install Forced Swim** and the screen shown in Figure A.2 will appear.

Figure A.2 – Click Install to Begin



The Customer Information screen, shown below will appear next. Enter the desired User Name and Company Name as well as the Password that was issued by MED Associates when the software was registered. Click **Next** to continue.

Figure A.3 – Customer Information Screen

The screenshot shows a Windows-style dialog box titled "Forced Swim - InstallShield Wizard". The main heading is "Customer Information" with a sub-instruction "Please enter your information." Below this, a larger text block says "Please enter your name, the name of the company for which you work and the product serial number." There are three input fields: "User Name:" with a text box containing "User Name", "Company Name:" with a text box containing "Company Name", and "Password:" with a text box containing "Password Issued When Software Registered". At the bottom left is the "InstallShield" logo. At the bottom right are three buttons: "< Back", "Next >", and "Cancel".

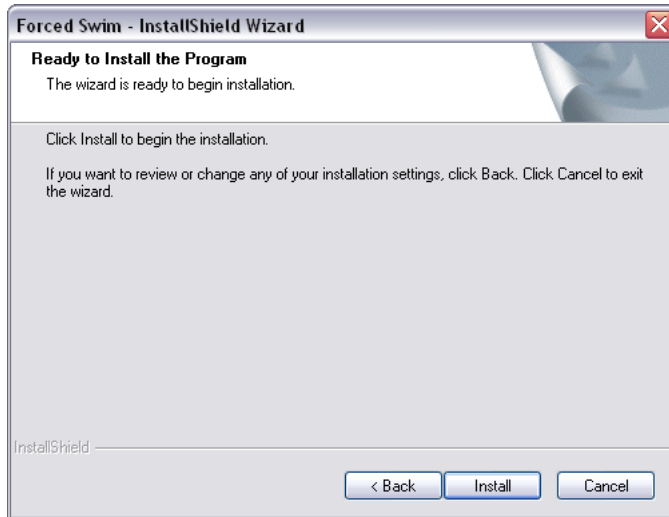
The Choose Destination Location screen, shown below appears next. Verify the Destination Folder. If this folder is acceptable, click **Next** to continue. If it is not, click **Browse...** and browse to the desired folder.

Figure A.4 – Choose Destination Location Screen

The screenshot shows a Windows-style dialog box titled "Forced Swim - InstallShield Wizard". The main heading is "Choose Destination Location" with a sub-instruction "Select folder where setup will install files." Below this, a text block says "Setup will install Forced Swim in the following folder." followed by "To install to this folder, click Next. To install to a different folder, click Browse and select another folder." There is a "Destination Folder" label above a text box containing the path "C:\Program Files\MED Associates\Forced Swim\". To the right of the text box is a "Browse..." button. At the bottom left is the "InstallShield" logo. At the bottom right are three buttons: "< Back", "Next >", and "Cancel".

The Ready to Install the Program screen, shown below will appear next. Click **Install** to begin installation.

Figure A.5 – Ready to Install the Program Screen



The software installation is now complete. Click **Finish** to close this screen.

Figure A.6 – Installation Complete

